Iranian Journal of Veterinary Science and Technology
Vol. 7, No. 1, 2015, 56-62

IJVST

Monocephalus thoracopagus conjoined twins in a goat

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Received: 10 September 2014 Accepted: 5 September 2015

Abstract

Monocephalus thoracopagus is a kind of attached symmetrical twin in which two nearly complete individuals joined front-to-front in the thoracic region with a single head, fused chests, one or two hearts and two lower bodies. A died female kid goat with one head, four ears, four paired limbs and two more or less complete body was referred to the Veterinary Faculty of the Shahid Bahonar University of Kerman. Detailed dissection was done on it and the progress of the duplication process of the internal organs was studied precisely. In the presented case, the way of the articulation of the ribs to the sterna and the progress of the duplication process in the alimentary canal can support the Spencer's spherical theory, saying that “a group of conjoined twins resulting from the union of two embryonic discs (or incomplete fission in one disc) over a common yolk sac”.

Keywords: Goat, monocephalus, thoracopagus, congenital, duplication

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Introduction

Congenital duplications are prominent among congenital defects due to involvement of two individuals. They form a graded series from slight duplication to near-separation of two fetuses and can be classified as free or attached asymmetrical or attached symmetrical twins (Hiraga and Dennis, 1993). Monocephalus thoracopagus is a kind of attached symmetrical twin in which two nearly complete individuals joined front-to-front in the thoracic region with a single head, fused chests with one or two shared hearts and two lower bodies (Spencer, 1992). It has been reported in the dog, cat, calf, sheep and goat (Potena, 1965; Sekeles, 1985; Mitra *et al*., 1994; Cazabon and Adogwa, 2003; Nottidge *et al*., 2007). The purpose of this article is to describe in detail the anatomical features of a Monocephalus thoracopagus kid goat.

Case description

A died female kid goat was referred to the faculty of Veterinary Medicine of Shahid Bahonar University with one head, four ears, four paired limbs and two bodies (Fig. 1). The mother had delivered two healthy kids in previous parturitions. It belonged to a small herd composed of 10 adult animals located in the countryside of Shahdad, Kerman province, Iran. No information of drug administration or teratogen exposure of the mother was available.



Figure 1. Dorsal view of the conjoined Monocephalus thoracopagus twins.

The computed tomographic examination revealed that a caudal duplication had been affected the skeleton up to the caudal bones of the skull. Two complete vertebral column were identified which had articulated to two complete set of occipital condyles. Each set of ribs had attached to a vertebral column proximally and to the two sternums distally.

On the other word each sternum had received a half set of ribs from each twin (Fig. 2).



Figure 2. 3D CT Image of the conjoined twins showing ribs articulation to one of the sternums. 1- Left ribs of the body A, 2- One of the sternums, 3- Right ribs of the body B.

Necropsy revealed that duplication of the axial skeleton had progressed to the level of the basilar bones of the skull, somehow between two set of condyles, two attached basioccipitals were observed. Rostral to them sphenoid bones were observed duplicated but still attached. Two hypophyseal fossae were observed on the dorsal surface of the bodies of attached basisphenoids. The central nervous system was also duplicated completely to the level of the metencephalon. Rostral to the duplicated metencephalon, hypophysis and hypothalamus were also seen duplicated.

Two tracheae were attached to the larynges (Fig. 3) proximally and had coursed distally to form four separate lungs. Two more or less complete diaphragms were also seen in the common thoracic cavity.

Each twin had a complete female urogenital system.

The digestive system had remained single up to the end of the esophagus. But partial duplication was seen in the rumen and reticulum. The common omasum was situated in the middle of the two reticula and had continued to the abomasum distally. Following the common pylorus, two duodenums had entered each abdominal cavity of two bodies and continued by distal parts of two sets of intestine. These parts had developed primitively somehow the jejunal loop and the spiral colon were not seen.

The cardiovascular anomalies were unique. Each twin had a heart with a normal pulmonary trunk and two ascending aortae. In the body A, the descending aorta had been formed by the union of the two converging arteries from the left ventricle. One of these arteries had given a branch which had coursed through the thoracic serousal septum to the

body B in order to participate in the formation of its descending aorta. Two other converging arteries from the left ventricle of the body B had also come to shape this aorta. It was interesting that the left subclavian artery of each body had entered to the ipsilateral and the right one to the contralateral thoracic limb. This happening was also observed in branching of the right and left intercostal arteries.

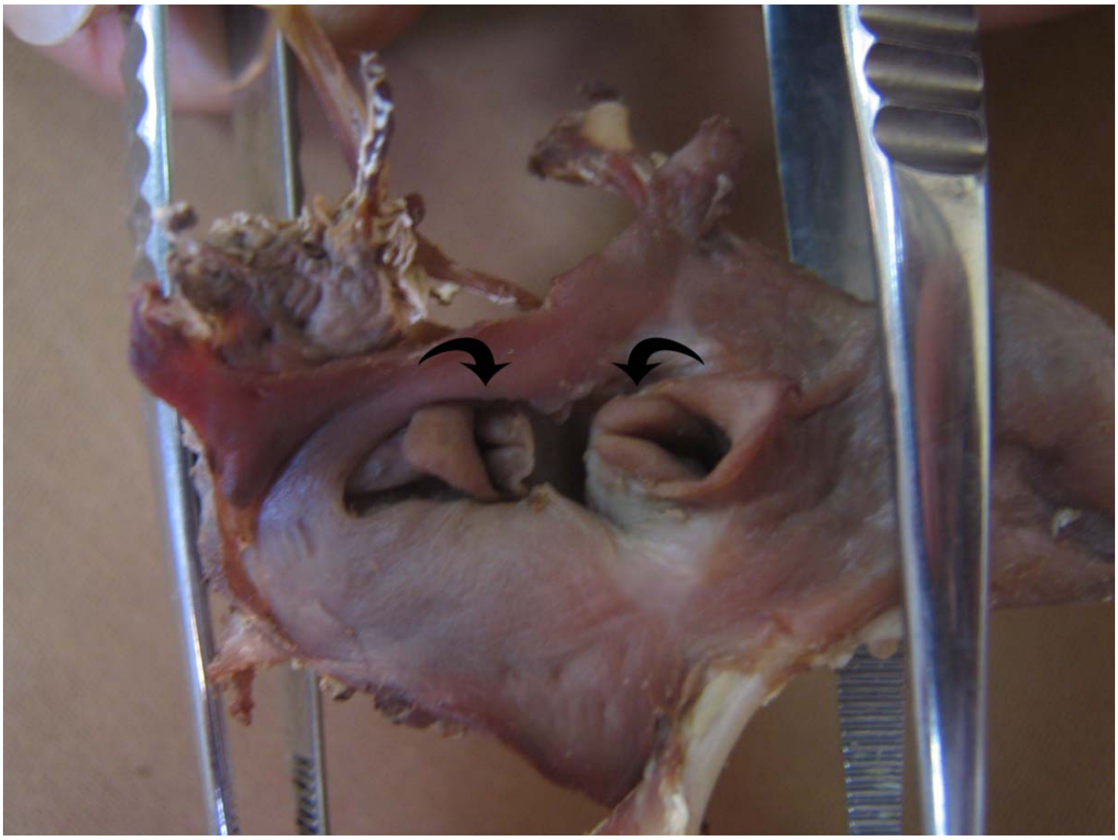


Figure 3. Dorsal view of the two laryngeal inlets (arrows).

Discussion

In recent years, increased numbers of caudal duplication anomalies in ruminants have been referred to the Faculty of Veterinary Medicine of Shahid Bahonar University of Kerman (Shojaei *et al*., 2010; Shojaei *et al*., 2012. two unpublished cases of monocephalus tetrabrachius tetrapus in a goat and a lamb). In the literature, frequency of caudally duplicated conjoined twins is dissimilar among different ruminants. It has been reported rarely in buffalo (Antoine *et al*., 1997), occasionally in the goat (Mitra *et al*., 1994; Corbera *et al*., 2005; Shojaei *et al*., 2012) and frequently in the cattle (Abt *et al*., 1962; Thakur, 1988; Hiraga and Dennis, 1993; Shojaei *et al*., 2010) and sheep (Dennis, 1975; Doijode *et al*., 1992; Hiraga and Dennis, 1993). It is not known whether embryonic duplications are caused by environmental or genetic factors or both (Roberts,1986), but according to similarities that exist in the environmental situations of the ruminants, an epidemiologic study may help to find out why this anomaly has been occurred frequently in these animals in the Kerman province.

In the caudally duplicated animals, the degree of the head duplication has been classified into three types. In type II there is one face and four ears which two of them placed on the back of the head (Hiraga and Dennis, 1993). In the present case, nearly

complete duplication was seen in the external feature of the limbs and bodies and the shared head characters verified type II monocephalus. But the duplication of the internal organs was not as simple as the external one. The progress of the duplication process in the alimentary canal was considerably less than the other internal organs. It means that the mechanism of the duplication of the yolk sac derivatives may differ from the other organs. On the other hand the way of articulation of the ribs to the sterna makes us to propose that the two embryonic discs overlay something (a common yolk sac) that prevented their proper lateral folding. So each sternum has formed between two halves of two embryos. Mentioned evidences can support the Spencer's spherical theory, saying that "a group of conjoined twins resulting from the union of two embryonic discs (or incomplete fission in one disc) over a common yolk sac" so typically duplication of the yolk sac derivatives occur after the other organs and the gastrointestinal tract has more shared portions than the other systems (Spencer, 2000).

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Iranian Journal of Veterinary Science and Technology
Vol. 7, No. 1, 2015, 56-62

IJVST

گزارش ناهنجاری مونوسفالوس توراکوپاگوس در بز

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دریافت مقاله : ۱۳۹۳/۰۸/۱۹ پذیرش نهایی : ۱۳۹۴/۰۶/۱۴

چکیده

مونوسفالوس توراکوپاگوس یکی از انواع دوقلوهای قرینه به هم چسبیده است که در آن دو حیوان تقریبا کامل، با یک سر، یک یا دو قلب و دو تنه که در ناحیه سینه به هم چسبیده اند دیده می شود. یک بزغاله ماده مرده با یک سر، چهار گوش، چهار جفت اندام حرکتی و دو تنه کم و بیش کامل به دانشکده دامپزشکی دانشگاه شهید باهنر کرمان ارجاع داده شد. حیوان به دقت تشریح، و میزان دوتایی شدن اندام های داخلی آن مطالعه شد. نحوه اتصال اندام های حرکتی سینه ای به جناغ های حیوان و میزان متفاوت دوتایی شدن در لوله گوارشی آن می تواند تاییدی بر نظریه "کروی بودن" اسپنسر باشد که می گوید: گروهی از دوقلوهای به هم چسبیده حاصل اتصال دو صفحه (و یا تقسیم ناقص یک صفحه)رویانی بر روی یک کیسه زرده مشترک هستند.

واژگان کلیدی: بز ، مونوسفالوس، توراکوپاگوس ، مادرزادی، دوتایی شدن